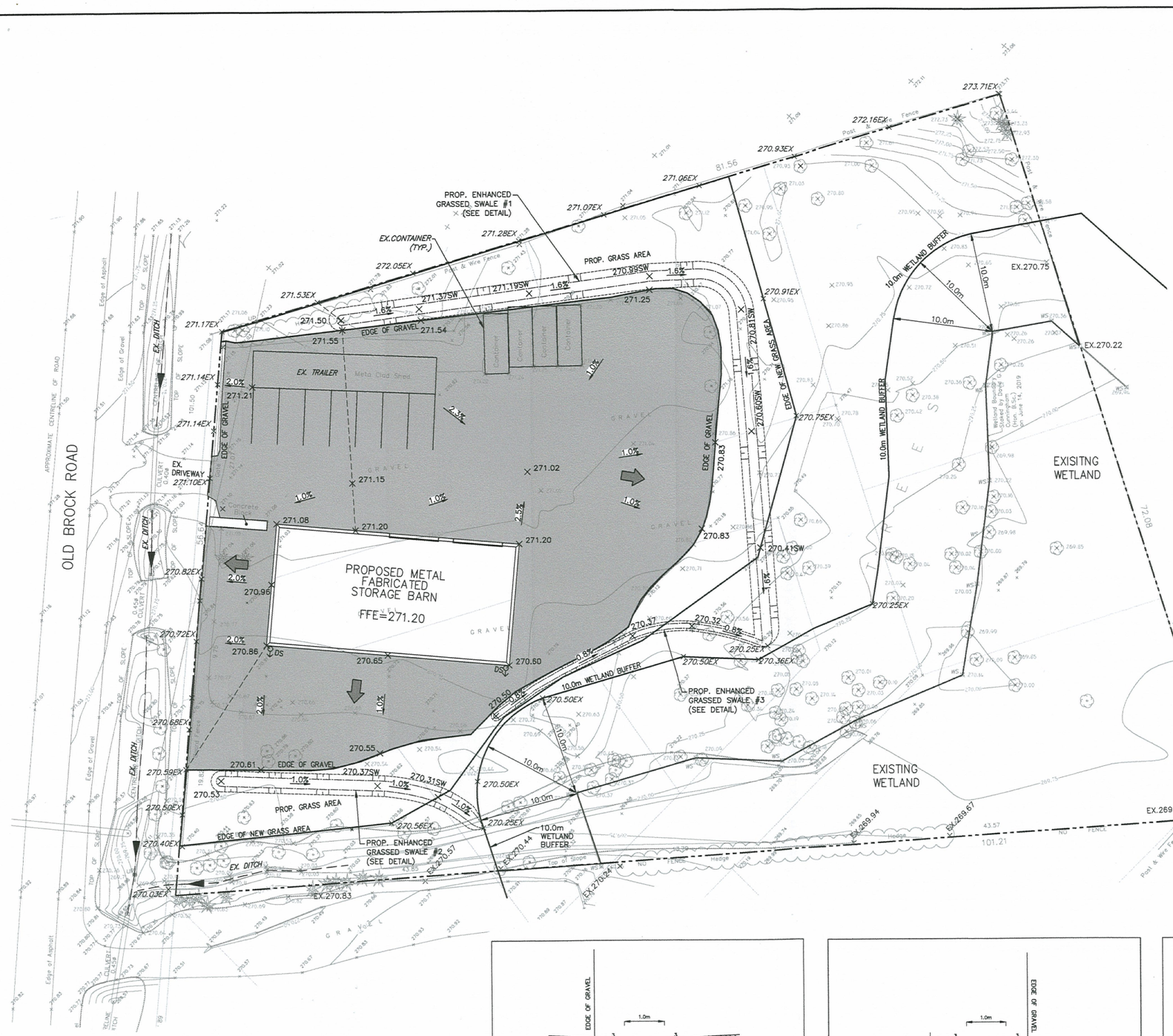
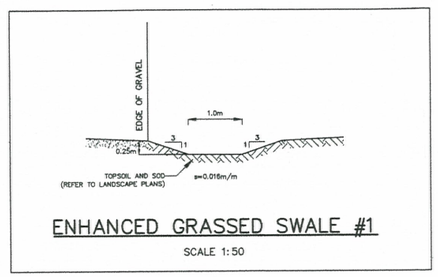
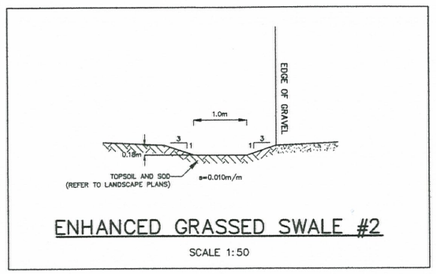
Tab 7





ENHANCED GRASSED SWALE #1

SCALE 1:50



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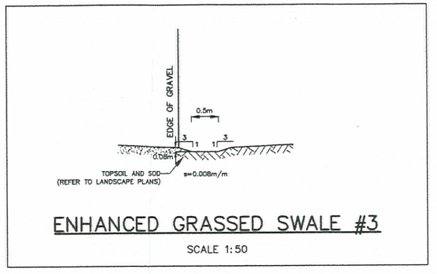

ENHANCED GRASSED SWALE #3

SCALE 1:50

KEY PLAN
N.T.S.

LEGEND:

+ 188.50EX	EXISTING ELEVATION
+ 188.50	PROPOSED ELEVATION
2.0%	PROPOSED SLOPE
	PROPOSED SWALE
	PROPOSED OVERLAND FLOW DIRECTION
FFE	FINISHED GROUND FLOOR ELEVATION
DS	ROOF DOWNSPOUT

METRIC:
DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

ELEVATION:
ELEVATIONS ARE GEODETIC AND ARE REFERRED TO THE CITY OF PICKERING BENCHMARK No.9-004 ELEVATION = 272.553m

No.	DATE	REVISION	BY

LICENSED PROFESSIONAL ENGINEER
R. R. THIBEAULT
100531958
JUN 9, 2021
PROVINCE OF ONTARIO

VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers
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PROPOSED CONTRACTOR'S YARD

5329 OLD BROCK ROAD
CITY OF PICKERING

SITE GRADING PLAN

SCALE	DATE OF DWG.	PROJECT NO.
1:200	JUNE. 9, 2021	21130
DRAWN BY: S.Y.	DRAWING NO.	SG-1
CHKD BY: D.G.		

Hydrogeological Assessment - 5329 Old Brock Road, Pickering, Ontario

2019-09-17

Prepared for:
1972229 Ontario Ltd.

CAMBIUM INC.
866.217.7900
cambium-inc.com

Peterborough | Barrie | Oshawa | Kingston

Executive Summary

1972229 Ontario Ltd. retained Cambium Inc. to complete a hydrogeological assessment in support of the redevelopment of the property at 5329 Old Brock Road in Pickering, Ontario. The property is currently occupied by a temporary shed and an existing gravelled yard, with grassy vegetation and trees around the perimeter, and a wet area along the southern and eastern limits. It is proposed to expand the gravelled parking area, as well as add an office trailer and storage barn.

A subsurface investigation was completed as part of a geotechnical investigation. The Site is overlain by sandy silt to silty sand till overburden soils.

Groundwater was encountered about 1 mbgs. Shallow groundwater flow was to the southeast and east at the Site. Regionally, the inferred groundwater flow is to the south toward Lake Ontario.

It is understood the proposed development will not involve large or deep excavations, as such, significant groundwater dewatering (over 50,000 L/day) will not be required. As a result, impacts to surrounding water resources are not anticipated from the proposed redevelopment.

A water balance assessment indicated that the post-development infiltration rate will be reduced by 91.5 m^3/year and the runoff rate increased by 420.6 m^3/year, when compared to the pre-development water balance. If Low Impact Development infiltration measures are considered, then the post-development infiltration rate will increase by 74.4 m^3/year while the runoff rate will increase by 254.7 m^3/year.

Respectfully submitted,

Cambium Inc.

PROFESSIONAL GEOSCIENTIST
LIMITED MEMBER
KEVIN D. WARNER
1456
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Mike Francis, GIT
Junior Hydrogeologist

Kevin Warner, M.Sc., P.Geo (Ltd).
Senior Project Manager, Senior Hydrogeologist

Mf/KDW

P:\8900 to 8999\8964-001 Grant Morris Associates Ltd. - Geo-Environmental Studies - 5329 Old Brock Road\Deliverables\REPORT - HydroG\Final\2019-09-17 Hydrogeological Assessment, 5329 Old Brock Rd.docx

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1.0 Introduction

1972229 Ontario Ltd. (Client) retained Cambium Inc. (Cambium) to undertake a Hydrogeological Assessment in support of the design and construction of a metal fabricated storage barn and an office trailer at 5329 Old Brock Road in Pickering, Ontario (the Site).

A hydrogeological assessment was undertaken to characterize the hydrogeological setting of the Site and assess the potential change in the water balance as a result of the proposed development. A geotechnical investigation was completed concurrently by Cambium (2019).

1.1 Site Description

The Site is about 100 m north of Hoxton Street within Hamlet of Claremont, Pickering. The 5,361 m² (0.54 ha) Site is roughly rectangular. The southeast corner of the property shares 5.62 m of property line with the CP rail property. The Site is flat and covered in grassy vegetation and mature growth trees around the perimeter. There is also a wet area with ponded surface water along the southern and eastern limits.

The Site is currently occupied by a small, temporary shed and an existing roughly 1,200 m^2 gravel yard. The Site is serviced by shallow dug well. As per information provided by the Client, the proposed development entails expanding gravelled driveway area to 1,580 m^2, with the addition of a new office trailer and a storage barn, with footprints of 67 m^2 and 223 m^2, respectively. The proposed development plan is included in Appendix A.

2.0 Methodology

The methodologies followed to complete the field investigation are outlined below.

2.1 Drilling Program

As part of the geotechnical investigation completed on June 20, 2019, four boreholes, (BH101-19 through BH104-19) were advanced. Boreholes BH101-19 and BH103-19 are proximal to proposed trailer footprint, borehole BH104-19 is within footprint of the proposed storage barn, and BH102-19 is within proposed gravelled driveway about 16 m south of the northern site boundary. BH101-19, BH103-19, and BH104-19 were advanced to 5 m below ground surface (mbgs). BH102-18 was advance to 6.5 mbgs. Drilling and sampling of the boreholes was completed using a track-mounted drilling rig, under the supervision of a Cambium technician.

The boreholes were advanced and sampled by means of continuous flight hollow stem augers with split-spoon samplers. Standard Penetration Test (SPT) N values were recorded for the sampled intervals as the number of blows required to drive a split-spoon (SS) sampler 305 mm into the soil using a 63.5 kg drop hammer falling 750 mm, as per ASTM D1586 procedures.

Soil samples were collected at 0.75 m intervals from 0 surface to 3.0 m and at 1.5 m intervals after below 3.0 m. The encountered soil units were logged in the field using visual and tactile methods, and samples were placed in labelled plastic bags for transport, future reference, laboratory testing, and storage. Open boreholes were checked for groundwater and general stability prior to backfilling.

Boreholes BH101-19, BH102-19, and BH104-19 were instrumented with 50 mm, schedule 40 PVC monitoring wells with 3 m screens.

The borehole locations were mapped using handheld GPS unit while elevations were surveyed relative to a benchmark (top culvert at the entrance to the Site). The geodetic elevation of the top of culvert at inlet side is 270.53 masl according to a survey plan provided by the Client. Borehole locations are shown on Figure 3. Borehole logs are included in Appendix B.

2.2 Physical Laboratory Testing

Physical laboratory testing, including three particle size distribution analyses (LS-702,705), was completed on selected soil samples to confirm textural classification and to assess geotechnical parameters. Moisture content testing was completed on all soil samples. Testing results are included in Appendix C and are discussed in Section 3.1.1.

2.3 Hydrogeological Field Tasks

On August 28, 2019, Cambium staff visited the Site to complete single-well hydraulic conductivity tests (slug tests) at BH101-19, BH102-19, and BH104-19.

Prior to conducting the testing, each well was purged of at least one well volume to clear out fine material and gauge the initial response of the well. Water level recovery back to static water level conditions was monitored using an automated water level logging device, and validated with manual measurements. Due to an observed slow recharge rate at monitor MW102-19, hydraulic testing could not be completed.

Slug testing was then completed at BH101-19 and BH104-19.

Hydraulic parameters were estimated using AquiferTest Pro™ software. The analysis results are presented in Appendix D and discussed in Section 3.5.

3.0 Geological and Hydrogeological Setting

The Site is in the Oak Ridges Moraine physiographic region. The Oak Ridges Moraine extends from the Niagara Escarpment to the Trent River and forms the height of the land dividing the streams of the Lake Ontario drainage basin from those flowing into Georgian Bay and the Trent River. It is over 160 km long, varies in width up to 13 km and is about 1,300 km^2. The surface is hilly with knob-and-basin relief typical of end moraine. The hills are primarily sandy or gravelly materials; however, in some areas (i.e., around Uxbridge) the hills consist of till that protrudes above the sand. The Oak Ridge Moraine is considered an area of aquifer recharge and a source for several streams that drain the till plains on either side of it. In general, water is interpreted to infiltrate vertically through the Oak Ridge Moraine, moving laterally only when reaching less pervious beds, and reappearing as springs along the slopes of the moraine (Chapman, L.J. and D.F. Putnam, 1984).

Soils in the area are mapped as Halton Till deposits, characterized by predominantly silt to silty matrix, high in matrix carbonate content and clast poor. In this area, the Halton Till exhibits a hummocky topography (Barnett, P.J.,Cowan, W.R. and Henry, A.P., 1991).

Bedrock in the area is mapped as Upper Ordovician deposits of shale, limestone, dolostone, and/or siltstone belonging to the Georgian Bay, Blue Mountain, and Billings Formations and includes the Collingwood and Eastview Members (OGS, 1991).

3.1 Subsurface Investigation

The results of the geotechnical investigation indicated that the subsurface conditions at the Site consisted predominantly of a thin veneer of silty sand soil overlying a silty-sand to sandy-silt till deposit. Organic topsoil was noted on the Site, but was not encountered by any of the boreholes. All boreholes were terminated in the overburden till soils; bedrock was not encountered to the maximum depth of investigation.

3.1.1 Grain Size Analyses

Laboratory grain size distribution analyses were completed on a sample collected from each of the boreholes with the exception of BH103-19. A summary of the grain size analyses results is presented in Table 1.

Table 1 Grain Size Analysis Results

Borehole	Depth (mbgs)	Material	%Gravel	%Sand	%Silt	%Clay
MW101-19	2.3-2.7	Sandy Silt some Clay trace Gravel	5	29	54	12
MW102-19	1.5-2.0	Sandy Silt some Clay trace Gravel	6	32	46	16
MW104-19	0.8-1.2	Silty Sand some Gravel some Clay	13	52	22	12

3.2 Source Protection Areas

The Ministry of Environment, Conservation and Parks (Ministry) Source Protection Information Atlas (SPIA) indicates that the Site is within an area identified as the Toronto Source Protection Area, and more specifically the Oak Ridges Moraine area identified as a Significant Groundwater Recharge Area (SGRA). The Site is not within a wellhead or intake protection zone.

3.3 Water Well Records

The Ministry's Water Well Information System (WWIS) was accessed to review records for water wells within 500 m of the Site. Forty-five well records were identified (see Figure 2) for 37 wells that are completed in overburden deposits, 30 of which are drilled wells and seven are dug wells, one monitoring well, and seven for which either no information was available, are a decommissioning record, or detail a dug well clean out.

Bedrock was not encountered by any of the wells, indicating that the overburden deposits extend to at least 89 mbgs. The well records indicate the overburden deposits consist primarily of clay with lesser amounts of coarser grained soil ranging from sand to stone (cobble) sized. These soils are interpreted to be the glacial till described in Section 3.0. In most of the well records, coarser grained sediments such as gravel and sand were identified near the termination depth of the well. It does not appear that these layers are particularly traceable from well to well and can likely be attributed to buried lenses and seams of coarse sediments.

The depth of the drilled wells ranged from about 11 to 98 mbgs. Static water levels that ranged from 0.00 mbgs to 37.80 mbgs. The depth of dug wells ranged from about 7 to 11 mbgs. Static water levels ranging from 2.00 mbgs to 6.10 mbgs. The average recommended pumping rates for the drilled and dug wells were 64.1 L/min (16.9 GPM) and 16.8 L/min (4.4 GPM), respectively.

3.4 Hydrogeological Conditions

A review of water well records for water wells in the area of the Site indicates that the overburden deposits extend to more than 98 mbgs in some areas. The overburden consists of primarily fine grained materials with secondary coarse grained particles (characteristic of the Oak Ridges Moraine). In the area of the Site, till overlies coarser grained deposits. Such stratigraphy is supported by the water well records reviewed, which indicate that a deep overburden aquifer is typically found at an average depth of 31 mbgs in sand and gravel deposits. The inferred regional groundwater flow in the deep overburden aquifer is to the south toward Lake Ontario.

The results of the drilling program indicated that a shallow aquifer system is present at the Site, with the water table encountered at about 1 mbgs. Water levels were measured on June 20 (after well installation), June 24, and August 28, 2019. The measured water levels and corresponding elevations are summarized in Table 2.

Table 2 Water Levels and Elevations

Borehole	Date of Observation	Depth of Groundwater	Groundwater Elevation (masl)
BH101-19	June 20, 2019	2.4 mbgs	268.33
	June 24, 2019	0.84 mbgs	269.89
	Aug. 28, 2019	1.13 mbgs	269.6
BH102-19	June 20, 2019	3.4 mbgs	267.23
	June 24, 2019	0.70 mbgs	269.93
	Aug. 28, 2019	1.12 mbgs	269.51
BH103-19	June 20, 2019	1.8 mbgs	268.72
BH104-19	June 20, 2019	1.0 mbgs	269.56
	June 24, 2019	0.84 mbgs	269.72
	Aug. 28, 2019	1.04 mbgs	269.52

Shallow groundwater flow was to the southeast in June and to the east in August.

3.5 Hydraulic Testing

Single well hydraulic (slug) tests were completed at BH101-19, BH102-19, and BH104-19 on August 28, 2019. The data generated from the tests was processed by AquiferTest Pro ™ software. Analysis results are summarized in Table 3.

Table 3 Hydraulic Testing Results

Well	Recovery	Slug in	Slug out	Average
MW101-19	7.12×10^{-7} m/s	1.75×10^{-6} m/s	2.13×10^{-6} m/s	1.53×10^{-6} m/s
MW102-19	1.82×10^{-7} m/s	-	-	-
MW104-19	2.50×10^{-6} m/s	1.17×10^{-5} m/s	1.17×10^{-5} m/s	8.63×10^{-6} m/s

BH101-19 and BH102-19 are screened in sandy silt that generated average hydraulic conductivities ranging from 1.82×10^{-7} m/s to 2.13×10^{-6} m/s. BH104-19 is screened in silty sand, with significantly more sand and less fine material as outlined in Table 1. This is reflected in the hydraulic conductivity analyses, which for BH104-19 are an order of magnitude higher than the results from the other two monitoring wells. Regardless, the hydraulic

conductivities of the screened intervals are typical of the sandy silt and silt sand units reported in literature (J.P.Powers, 2007; Fetter, 2001).

3.6 Assessment of Hydrogeological Impacts

The proposed development plan is included in Appendix A. The proposed development entails expanding the gravelled driveway area to 1,580 m^2, and the addition of two a new office trailer and a storage barn, with footprints of 67 m^2 and 223 m^2, respectively. Neither the office trailer nor the storage barn will include any substantial subsurface works or excavation. It is understood the proposed development will not involve large or deep excavations. As such, significant groundwater dewatering (over 50,000 L/day) should not be required; therefore, impacts to surrounding water resources as a result of the construction of the structures are not anticipated.

4.0 Water Balance

Cambium completed pre- and post-development water balances to assess the potential impact of the development on local groundwater and surface water resources. To complete the assessment the following equations were utilized:

$$QI = A \times S \times I$$

Where:
- QI - Infiltration Volume (m^3/yr)
- A - Area (m^2)
- S - Water surplus (m/yr)
- I - Infiltration factor (dimensionless)

$$QR = A \times S \times (1-I)$$

Where:
- QR - Runoff Volume (m^3/yr)
- A - Area (m^2)
- S - Water surplus (m/yr)
- I - Infiltration factor (dimensionless)

The 5,361 m^2 Site has grassy areas with mature growth trees around the perimeter, a 1,220 m^2 gravelled area, and wet areas with ponded surface water at the southern and eastern limits.

The proposed development includes an expanded gravelled driveway area 1,580 m^2, with a 67 m^2 office trailer and a 223 m^2 Storage Barn.

4.1 Water Surplus

Water surplus is calculated by determining the difference between precipitation and evapotranspiration (soil water storage was assumed to be negligible over the course of a year). The volume of water surplus is further sub-divided into portions that infiltrate the on-site soil and that are directed off-site as runoff.

According to the Environment Canada Climatic Normals (1981-2010) for the Toronto Buttonville Airport Station (Environment Canada, 2019), the average annual precipitation is 853 mm/year.

The Thorthwaite method was used to determine the amount of evapotranspiration that will occur at the Site (S. Lawrence Dingman, 2008). The calculated depth of evapotranspiration was 576 mm/year. The water surplus for the Site was calculated to be 277 mm/year. The evapotranspiration calculations are included in Appendix E.

4.2 Infiltration of Water Surplus

The volume of water surplus that infiltrates into the on-site soil was determined by applying an infiltration factor to the surplus volume. The surplus water that does not infiltrate into the ground will leave the Site as surface water runoff. The infiltration factor varies from 0 to 1 and is estimated based on topography, soil type, and vegetation cover as per the *Stormwater Management Planning and Design Manual* (MOE, 2003). At present, the Site is relatively flat. The grade of the Site is not expected to change upon completion of the proposed development.

The infiltration factors used for the Site are summarized in Table 4. The infiltration rate of the landscaped/vegetated areas is 0.65 of the surplus.

Evapotranspiration does not occur from gravel areas and impervious areas. It was assumed that 10% of precipitation falling on the gravel and impervious areas is lost directly to evaporation. The remaining 90% was considered surplus and converted to infiltration and/or runoff. As such, the surplus from these areas is estimated to be 768 mm/yr. An infiltration factor of 0.10 of the precipitation is used for the gravel areas and 0.0 is used for impervious surfaces (i.e. roof area of the proposed structures).

Table 4 Infiltration Factors

Infiltration Factors			
	Vegetated Areas	Gravelled Areas	Impervious Surfaces
Topography	Flat – 0.25		
Soil	Sandy Silt Soils – 0.25		
Cover	Grass/Vegetated – 0.15		
Infiltration Factor	0.65	0.10	0.00

4.3 Pre-Development

The results of the pre-development water balance are summarized in Table 5. The pre-development infiltration rate of the Site is 841.4 m³/year while the runoff generated equates to 1,232.8 m³/year.

Table 5 Pre-Development Water Balance

	Area (m^2)	Infiltration Factor	Annual Precip/Surplus (m^3/yr)	Groundwater Recharge (m^3/yr)	Runoff (m^3/yr))	Total
Vegetated Areas	4,161	0.65	0.277	749.2	403.4	1,152.6
Existing Gravel Area	1,200	0.10	0.768	92.2	829.4	921.6
Total	5,361			841.4	1,232.8	2,074.2

4.4 Post-Development

The proposed development plan includes the addition of a Storage Barn (223 m^2) and an Office Trailer (67 m^2), in addition to an expanded gravel driveway/parking area (1,580 m^2). The Storage Barn and Office Trailer structures would be deemed impervious areas, which will total 290 m^2.

The results of the post-development water balance calculations are summarized in Table 6. The post-development infiltration rate of the Site is 749.9 m^3/year and the runoff discharge would equate to 1,653.4 m^3/year.

Table 6 Post-Development Water Balance

	Area (m^2)	Infiltration Factor	Annual Precip/Surplus (m/yr)	Groundwater Recharge (m^3/yr)	Runoff (m^3/yr)	Total (m^3/yr)
Landscaped / Vegetated Land	3,491	0.65	0.277	628.6	338.5	967.1
Proposed Storage Barn	223	0.0	0.768	0.0	171.3	171.3
Proposed Office trailer	67	0.0	0.768	0.0	51.5	51.5
Gravelled Driveway Areas	1,580	0.1	0.768	121.3	1,092.1	1,213.4
Total	**5,361**			**749.9**	**1,653.4**	**2,403.3**

4.5 Water Balance Comparison

The infiltration rate under post-development conditions is reduced by 91.5 m^3/year while the runoff rate is increased by 420.6 m^3/year. The infiltration reduction equates to a loss of streamflow of 0.003 L/s, while the increase in runoff equates to 0.013 L/s.

In total, the surplus water at the Site is increased from 2,074.2 m^3/yr to 2,403 m^3/yr, which is attributed to a reduction of vegetated surfaces with a subsequent decrease in evapotranspiration while the addition of the impervious surfaces (gravel area and structures) increases the amount of runoff generated from the Site.

A comparison of the pre and post-development conditions is provided in Table 7.

Table 7 Comparison of Pre- and Post-Development Conditions

	Groundwater Recharge (m^3/yr)	Runoff (m^3/yr)	Total (m^3/yr)
Pre-Development	841.4	1,232.8	2,074.2
Post-Development	749.9	1,653.4	2,403.3
Difference	**- 91.5**	**+420.6**	**+329.1**

4.6 Low Impact Development Measures

To mitigate groundwater infiltration losses associated with the proposed development, runoff generated from the proposed structures and expanded gravelled area can be directed to Low Impact Development (LID) infiltration facilities.

The proposed Site Plan for development includes spot elevations across the Site. The gravelled area is sloped downwards toward the south and east where vegetated areas are identified. Consideration should be made for inclusion of an enhanced grassed swale along the edge of the southern and eastern margins of the gravelled area to capture runoff. For additional information regarding enhanced grassed swale, refer to the *Low Impact Development Stormwater Management Planning and Design Guide* (Credit Valley Conservation, 2010).

The proposed development plan includes the addition of a Storage Barn (223 m^2) and an Office Trailer (67 m^2), in addition to the expanded gravel driveway/parking area (1,580 m^2). The Storage Barn and Office Trailer structures would be deemed impervious areas, which will

total 290 m². Runoff generated from roof downspouts should be directed to a pervious area to allow some infiltration into the subsurface. Considering the rural location of the Site, there are no storm sewer systems in the vicinity, as such runoff will enter naturalized or vegetated areas at the margins of the gravelled area. Furthermore, the Site is located in a designated Significant Groundwater Recharge Zone; as such is it anticipated that runoff generated from the developed portion of the Site will likely infiltrate into the subsurface in the naturalized or vegetated areas of the property.

Based on the LID planning and design guide, if the infiltration facilities are designed correctly they can infiltrate up to 20% of the runoff generated from the proposed structures and expanded gravel areas.

By incorporating LIDs for the Site (direct downspout recharge from the proposed structures and an enhanced grassed swale around the gravelled areas, the rate of infiltration for the Site is increased to 915.8 m³/year, which is 9% greater than existing conditions. Conversely, the runoff rate will be 1,487.5 m³/year, which is only 21% greater than existing conditions.

The post-development water balance, including infiltration from runoff re-infiltration facilities, is summarized in Table 8.

Table 8 Post-Development Water Balance Including LIDs

	Area (m^2)	Infiltration Factor	Annual Precip/Surplus (m/yr)	Groundwater Recharge (m^3/yr)	Runoff (m^3/yr)	Total (m^3/yr)
Landscaped / Vegetated Land	3,491	0.65	0.277	628.6	338.5	967.1
Downspout directed to Enhances Grassed Swale	290	0.2	0.768	44.5	178.2	222.7
Enhanced Grassed Swale around Gravel Areas (no underdrain)	1,580	0.2	0.768	242.7	970.8	1,213.5
Total	**5,361**			**915.8**	**1,487.5**	**2,403.3**

4.7 Water Balance Comparison

The post-development water balance results in an 11% reduction in groundwater infiltration, and an increase in runoff of 34%. If LID infiltration facilities are installed to re-infiltrate roof and parking area runoff, the infiltration rate increases by 9% (when compared to pre-development conditions), and the runoff rate increases only 21%.

The water balances outlined above indicate that if underground re-infiltration facilities are used to capture runoff generated from the structure and parking area, that annual infiltration rate will increase by 9% when compared to the pre-development infiltration rate. Therefore, groundwater infiltration will be maintained (at least) upon development of the Site.

The Client should consult with the City of Pickering, The Region of Durham and the TRCA regarding what type of LID groundwater re-infiltration features are acceptable as part of the proposed development.

The pre-development, post-development, and post-development (including LID measures) water development scenarios are summarized in Table 9.

Table 9 Water Balance Comparison with LID's

	Groundwater Recharge (m^3/yr)	Difference from Pre-Development Conditions	Runoff (m^3/yr)	Difference from Pre-Development Conditions	Total (m^3/yr)
Pre-Development	841.4	-	1,232.8	-	2,074.2
Post-Development	749.9	-11%	1,653.4	+34%	2,403.3
Post-Development (Including LID Measures)	915.8	+9%	1,487.5	+21%	2,403.3

5.0 Closing

1972229 Ontario Ltd. Retained Cambium to complete a hydrogeological assessment for 5329 Old Brock Road in Pickering, Ontario.

The assessment indicated overburden soils consist of sandy silt to silty sand till extending to at least 98 mbgs. The water table was about 1 mbgs. Shallow groundwater flow was to the southeast and east at the Site. Regionally, the inferred groundwater flow is to the south toward Lake Ontario.

It is understood the proposed development will not involve large or deep excavations (structures include a mobile trailer and slab on grade storage barn); therefore, significant groundwater dewatering (over 50,000 L/day) is not required. As a result, impacts to surrounding water resources are not anticipated from of the construction of the structures.

The water balance assessment indicated that the post-development infiltration rate is reduced by 91.5 m^3/year and the runoff rate increased by 420.6 m^3/year, when compared to the pre-development water balance. If LID infiltration measures are considered, then the post-development infiltration rate will increase by 74.4 m^3/year while the runoff rate will increase by 254.7 m^3/year.

6.0 References

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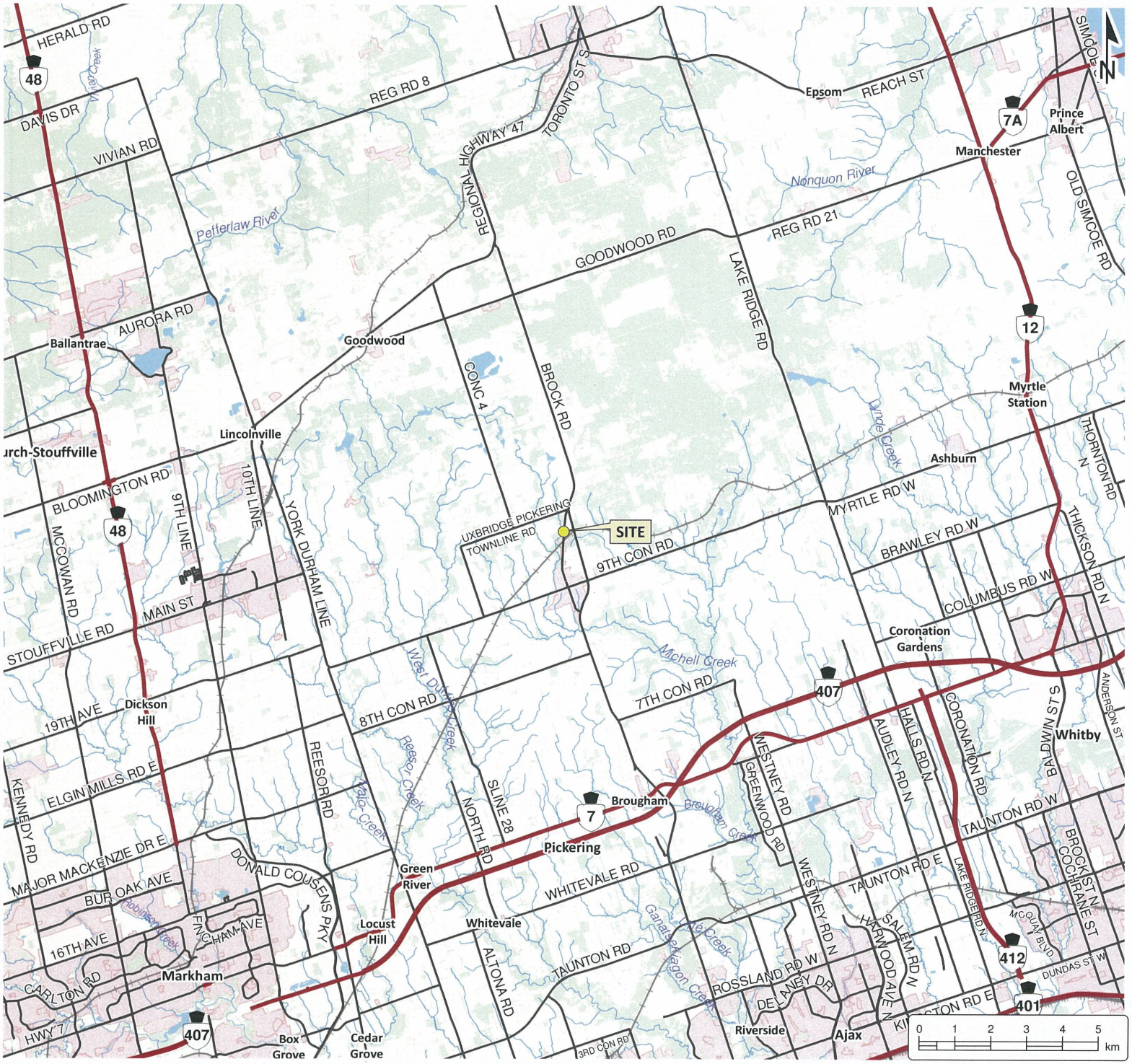
S. Lawrence Dingman. (2008). *Physical Hydrology, Second Edition.*

Appended Figures

HYDROGEOLOGICAL ASSESSMENT - 5329 OLD BROCK ROAD

GRANT MORRIS ASSOCIATES LTD.
5329 Old Brock Road,
Pickering, Ontario



LEGEND

- Highway
- Major Road
- Railroad
- Watercourse
- Water Area
- Built-Up Area
- Wooded Area

Notes:
- Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.

CAMBIUM
P.O. Box 325, 52 Hunter Street East
Peterborough, Ontario, K9H 1G5
Tel: (705) 742.7900 Fax: (705) 742.7907
www.cambium-inc.com

REGIONAL LOCATION PLAN

Project No.: 8964-001		Date: September 2019	Rev.:
Scale: 1:150,000		Projection: NAD 1983 UTM Zone 17N	
Created by: MAT	Checked by: KW	Figure: 1	

O:\GIS\project_MXDs\8900 to 8999\8964-001 Grant Morris Associates Ltd. - Geo-Environmental Studies - 5329 Old Brock Road\2019-09-17 FIG 1 Regional Location Plan.mxd

HYDROGEOLOGICAL ASSESSMENT - 5329 OLD BROCK ROAD

GRANT MORRIS ASSOCIATES LTD.
5329 Old Brock Road,
Pickering, Ontario

LEGEND

- Well
- 500m Perimeter
- Subject Property

Notes:
- Base mapping features were obtained from the Municipality of Durham online GIS database, accessed September 2019.
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.

CAMBIUM
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Peterborough, Ontario, K9H 1G5
Tel: (705) 742.7900 Fax: (705) 742.7907
www.cambium-inc.com

MECP WELL RECORDS

Project No.: 8964-001		Date: September 2019	Rev.:
Scale: 1:6,000		Projection: NAD 1983 UTM Zone 17N	
Created by: MAT	Checked by: KW	Figure: 2	

O:\GIS\project_MXDs\8900 to 8999\8964-001 Grant Morris Associates Ltd. - Geo-Environmental Studies - 5329 Old Brock Road\2019-09-17 FIG 2 MECP Well Records.mxd

HYDROGEOLOGICAL ASSESSMENT - 5329 OLD BROCK ROAD

GRANT MORRIS ASSOCIATES LTD.
5329 Old Brock Road,
Pickering, Ontario

LEGEND

- Borehole
- Benchmark
- Monitoring Well
- Subject Property

Groundwater levels measured as of August 28, 2019.

Notes:
- Base mapping features were obtained from Google Earth 2018 imagery, retrieved June 2019.
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.

Benchmarks:
BM1 - The top edge of a culvert located at the northern end of the driveway, adjacent to Old Brock Road.

CAMBIUM
P.O. Box 325, 52 Hunter Street East
Peterborough, Ontario, K9H 1G5
Tel: (705) 742.7900 Fax: (705) 742.7907
www.cambium-inc.com

SITE PLAN

Project No.:	8964-001	Date:	September 2019
		Rev.:	
Scale:	1:750	Projection:	NAD 1983 UTM Zone 17N
Created by:	MAT	Checked by:	KW
Figure:	3		

O:\GIS\project_MXDs\8900 to 8999\8964-001 Grant Morris Associates Ltd. - Geo-Environmental Studies - 5329 Old Brock Road\2019-09-17 FIG 3 Site Plan.mxd

Appendix A

Proposed Development Plan and Land Information

TOPOGRAPHIC SKETCH SHOWING

LOTS 16, 17, 18, AND 20
AND PART OF LOTS 15, 19, 21 AND 22
AND PART OF ALFRED STREET
AND PART OF TRACEY STREET,
REGISTERED PLAN 94

GEOGRAPHIC TOWNSHIP OF PICKERING,
NOW IN THE,

CITY OF PICKERING

REGIONAL MUNICIPALITY OF DURHAM

SCALE 1:250

0 1 2 3 4 5 10 15 20 metres

Metric

DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

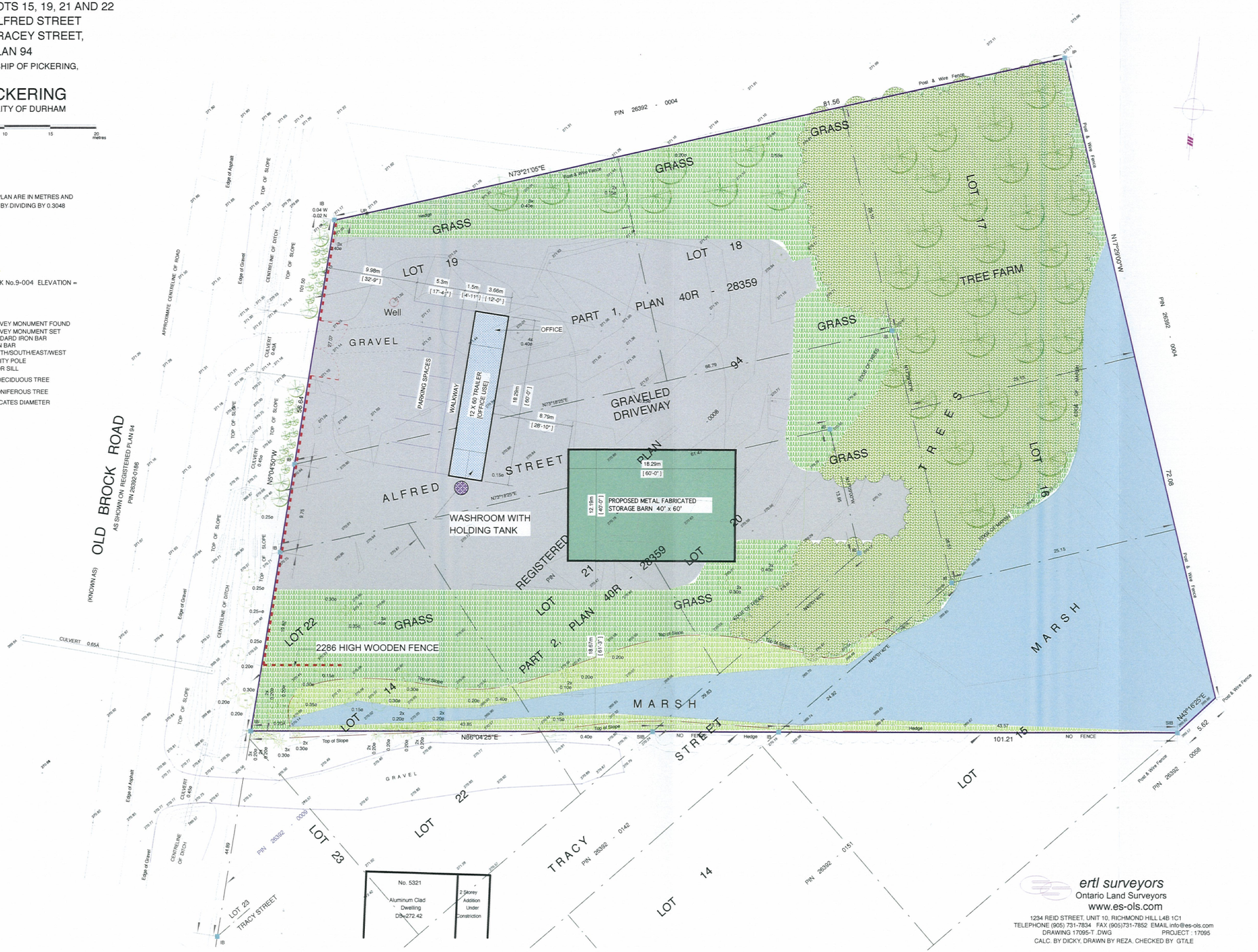
SURVEY PREPARED FOR:
LEISURE POOLS OF TORONTO
ART SIMPATICO

Benchmark

CITY OF PICKERING BENCHMARK No.9-004 ELEVATION = 272.553 m

Notes

■	DENOTES	SURVEY MONUMENT FOUND
□	DENOTES	SURVEY MONUMENT SET
SIB	DENOTES	STANDARD IRON BAR
IB	DENOTES	IRON BAR
N/S/E/W	DENOTES	NORTH/SOUTH/EAST/WEST
UP	DENOTES	UTILITY POLE
DS	DENOTES	DOOR SILL
	DENOTES	DECIDUOUS TREE
	DENOTES	CONIFEROUS TREE
Ø	DENOTES	INDICATES DIAMETER



ertl surveyors
Ontario Land Surveyors
www.es-ols.com
1234 REID STREET, UNIT 10, RICHMOND HILL L4B 1C1
TELEPHONE (905) 731-7834 FAX (905)731-7852 EMAIL info@es-ols.com
DRAWING 17095-T .DWG PROJECT : 17095
CALC. BY DICKY, DRAWN BY REZA, CHECKED BY GT/LE

TVAL DESIGN
PLANNING & DESIGN CONSULTANTS
8 WELLESLEY ST
EAST SUITE 702
TORONTO, ONTARIO,
M4Y 3B2

No.	Date	Issuance and or Revisions	By
1	08 17	ISSUED FOR CLIENT REVIEW	AD

Revisions:

The undersigned has reviewed & taken responsibility for this design and has the Qualifications and meets the requirements set out in the Ontario Building Code to be a designer.

QUALIFICATION INFORMATION
Required unless design is exempt under 2.17.5.1 of the building code

TONY VALENTIN	20917 BCIN
Name	
Signature	27 11 18 Date

REGISTRATION INFORMATION
Required unless design is exempt under 2.17.4.1 of the building code

TONY VALENTIN DESIGN	28858 BCIN
Firm Name	

Grant Morris Associates Ltd.
PLANNING & DEVELOPMENT CONSULTANTS
397 SHEPPARD AVE. , PICKERING, ONTARIO L1V 1E6
TEL NO. (905) 420 3990 FAX NO.(905) 420-3990
EMAIL: grant.morris@rogers.com

Project title:

PROPOSED DEVELOPMENT

5329 OLD BROCK ROAD
CITY OF PICKERING

CLIENT:

Drawing title:

SITE PLAN & STATISTICS

Drawn By:	Arnel
Designed By:	
Checked By:	
Date:	AUG 2017
Scale:	1:200 M

project no

sheet no
A1
of sheets

Appendix B
Borehole Logs

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: MW102-19

Client: 1972229 Ontario Ltd. **Project Name:** Geo-Environmental Studies **Project No.:** 8964-001

Contractor: Drilltech **Method:** Solid Stem Auger **Date Completed:** June 20, 2019

Location: 5329 Old Brock Road, Pickering **UTM:** 17T 649896 m E 4871971 m N **Elevation:** 270.630 masl

Elevation (m) / Depth	Description	Number	Type	% Recovery	SPT (N) / DCPT	Well Installation	Remarks
270 / 0	SILTY SAND: Brown silty sand, some gravel, trace clay, compact	1	SS	75	14		
269 / 1	SANDY SILT: Light brown sandy silt till, trace gravel, some clay, compact	2	SS	60	8	PVC Riser; Bentonite Plug	
268 / 2		3	SS	100	13		: GSA SS3: 6% Gravel 32% Sand 46% Silt 16% Clay
		4	SS	100	12		
267 / 3	SANDY SILT: -become grey	5	-	0	10		
266 / 4		6	SS	90	9	Sand Pack; PVC Screen	Water level at 3.4 mbgs upon completion
265 / 5		7	SS	75	14		
264 / 6	Borehole terminated at 6.5 mbgs in sandy silt till					Cap	
7							

% Moisture: 25 50 75

SPT (N) / DCPT: 10 20 30 40

Logged By: P.Ahuja **Input By:** Z. Luo

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: MW101-19

Client: 1972229 Ontario Ltd. **Project Name:** Geo-Environmental Studies **Project No.:** 8964-001

Contractor: Drilltech **Method:** Solid Stem Auger **Date Completed:** June 20, 2019

Location: 5329 Old Brock Road, Pickering **UTM:** 17T 649875 m E 4871967 m N **Elevation:** 270.730 masl

SUBSURFACE PROFILE				SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
271 / 0		SILTY SAND: Brown silty sand, some gravel, trace clay, compact	1	SS	70	9				
270 / 1		SANDY SILT: Light brown sandy silt till, trace gravel, some clay, compact	2	SS	100	16			PVC Riser; Bentonite Plug	
269 / 2			3	SS	100	21				
268 / 3		SANDY SILT: -become grey	4	SS	100	17				: GSA SS4: 5% Gravel 29% Sand 54% Silt 12% Clay
267 / 4			5	SS	75	22			Sand Pack; PVC Screen	
266 / 5			6	SS	85	13			Cap	Water level at 2.4 mbgs upon completion
		Borehole terminated at 5.0 mbgs in sandy silt till								

Logged By: P.Ahuja **Input By:** Z. Luo

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH103-19

Client:	1972229 Ontario Ltd.	**Project Name:**	Geo-Environmental Studies	**Project No.:**	8964-001
Contractor:	Drilltech	**Method:**	Solid Stem Auger	**Date Completed:**	June 20, 2019
Location:	5329 Old Brock Road, Pickering	**UTM:**	17T 649876 m E 4871956 m N	**Elevation:**	270.523 masl

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
270 / 0		SILTY SAND: Brown silty sand, some gravel, trace clay, compact	1	SS	100	25				
		SANDY SILT: Light brown sandy silt till, trace gravel, some clay, loose to compact	2	SS	100	4				
269 / 1										
			3	SS	90	7				
268 / 2										
			4	SS	90	9				
		SANDY SILT: -become grey								
267 / 3			5	SS	80	17				
266 / 4										
			6	SS	80	16				Water level at 1.8 mbgs upon completion
265 / 5		Borehole terminated at 5.0 mbgs in sandy silt till								

Logged By: P.Ahuja **Input By:** Z. Luo

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: MW104-19

Client: 1972229 Ontario Ltd. **Project Name:** Geo-Environmental Studies **Project No.:** 8964-001

Contractor: Drilltech **Method:** Solid Stem Auger **Date Completed:** June 20, 2019

Location: 5329 Old Brock Road, Pickering **UTM:** 17T 649895 m E 4871955 m N **Elevation:** 270.555 masl

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
270 / 0		SILTY SAND: Brown sand and silt, some gravel, trace clay, compact	1	SS	60	10				
1			2	SS	75	2			PVC Riser	
269		SANDY SILT: Light brown sandy silt till, trace gravel, some clay, very loose to compact							Bentonite Plug	
2			3	SS	90	6				
268			4	SS	75	6				: GSA SS4: 13% Gravel 52% Sand 22% Silt 12% Clay
3		SANDY SILT: -become grey	5	SS	100	9				
267									Sand Pack	
4									PVC Screen	
266			6	SS	100	12			Cap	Water level at 1.0 mbgs upon completion
5		Borehole terminated at 5.0 mbgs in sandy silt till								

Logged By: P.Ahuja **Input By:** Z. Luo

Appendix C
Grain Size Analyses

Grain Size Distribution Chart

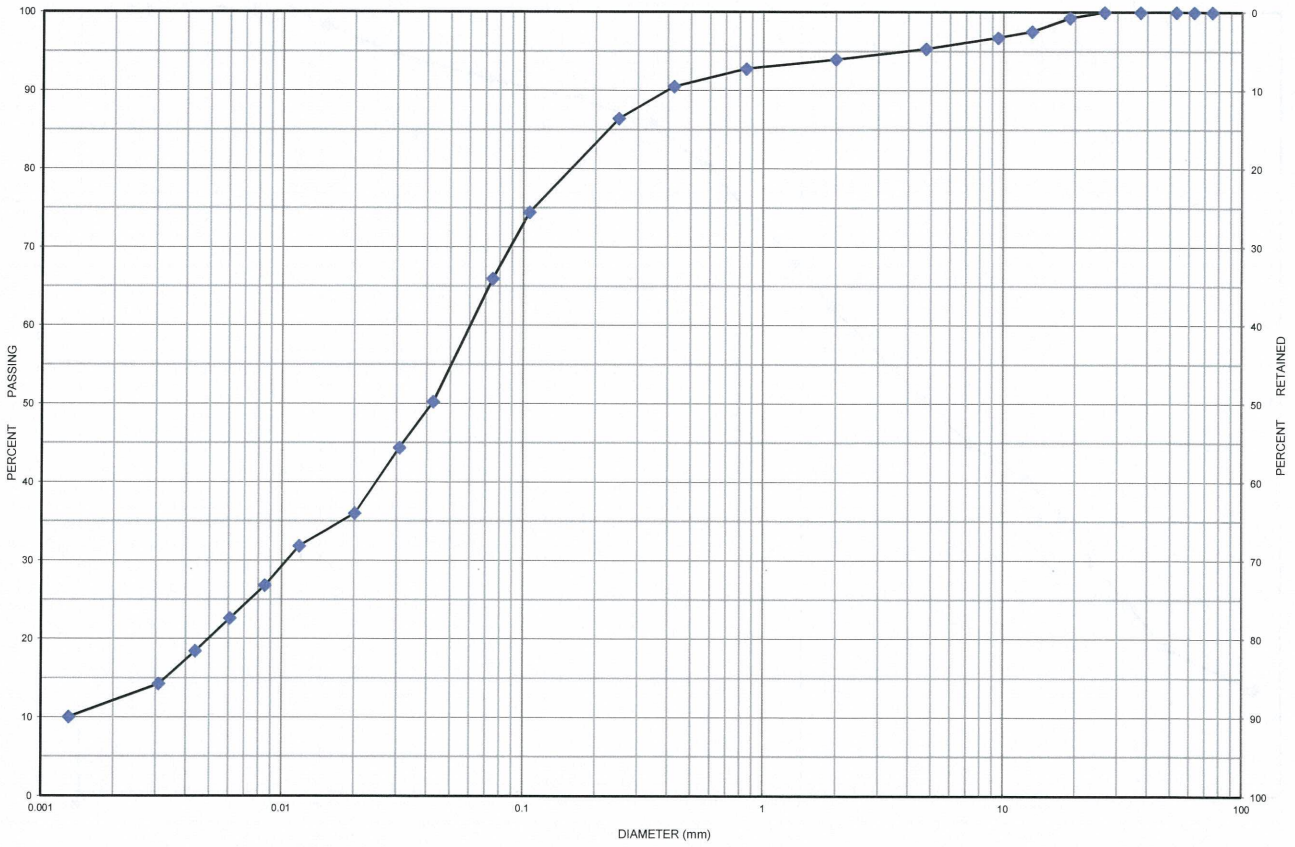
Project Number: *8964-001* **Client:** *1972229 Ontario Ltd.*

Project Name: *Geo-Environmental Studies - 5329 Old Brock Road*

Sample Date: *June 24, 2019* **Sampled By:** *Prateek Ahuja - Cambium Inc.*

Location: *BH 101-19 SS 4* **Depth:** *2.3 m to 2.7 m* **Lab Sample No:** *S-19-0460*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 101-19	SS 4	2.3 m to 2.7 m	5	29	66		12.7

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sandy Silt some Clay trace Gravel	ML	0.062	0.011	0.0013	47.69	1.50

Issued By: _____ *Date Issued:* *July 8, 2019*

(Senior Project Manager)

Cambium Inc. (Laboratory)
866.217.7900 | cambium-inc.com
701 The Queensway | Units 5-6 | Peterborough | ON | K9J 7J6

Grain Size Distribution Chart

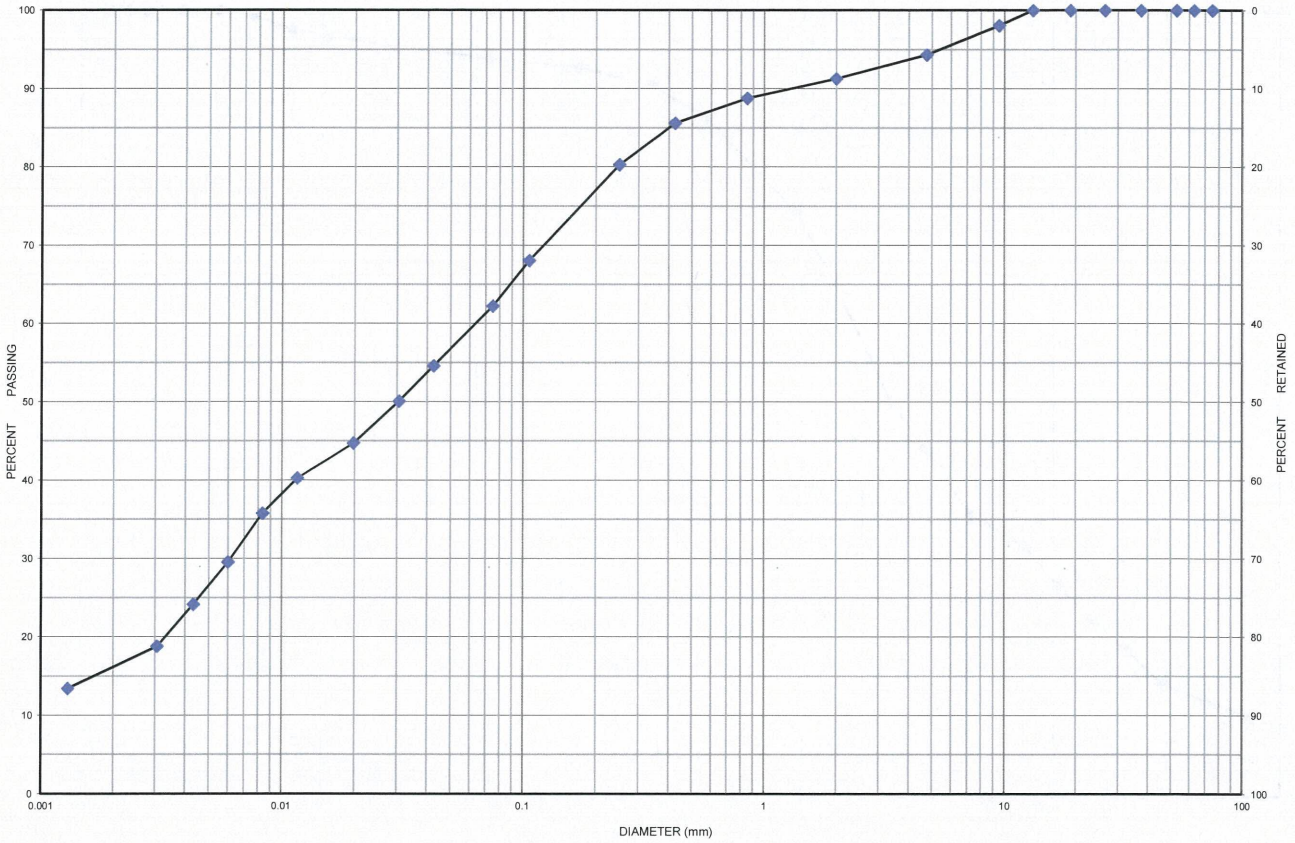
Project Number: *8964-001* **Client:** *1972229 Ontario Ltd.*

Project Name: *Geo-Environmental Studies - 5329 Old Brock Road*

Sample Date: *June 24, 2019* **Sampled By:** *Prateek Ahuja - Cambium Inc.*

Location: *BH 102-19 SS 3* **Depth:** *1.5 m to 2 m* **Lab Sample No:** *S-19-0461*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 102-19	SS 3	1.5 m to 2 m	6	32	62		11.8

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sandy Silt some Clay trace Gravel	ML	0.064	0.0063	-	-	-

Issued By: _____ *Date Issued:* *July 8, 2019*

(Senior Project Manager)

Cambium Inc. (Laboratory)

866.217.7900 | cambium-inc.com

701 The Queensway | Units 5-6 | Peterborough | ON | K9J 7J6

Grain Size Distribution Chart

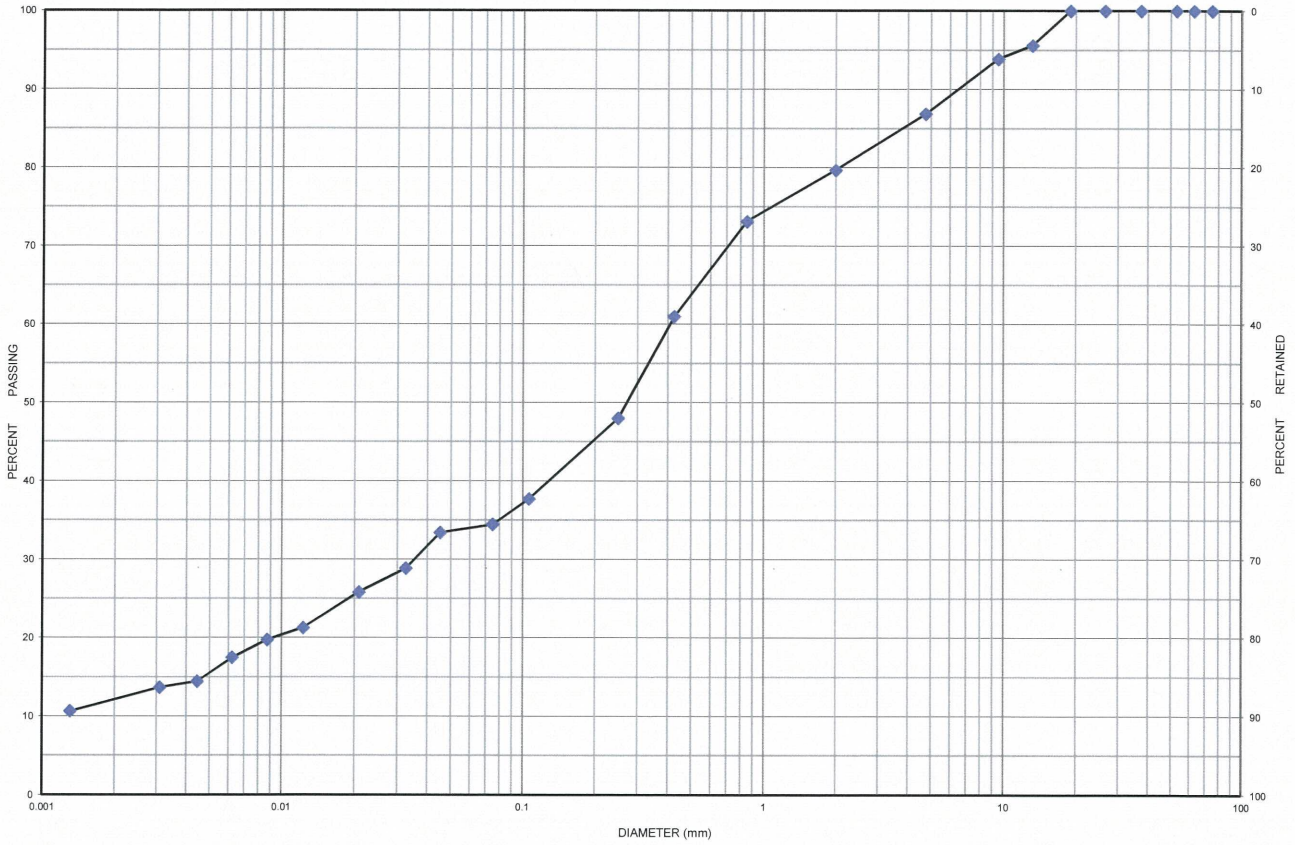
Project Number: *8964-001* **Client:** *1972229 Ontario Ltd.*

Project Name: *Geo-Environmental Studies - 5329 Old Brock Road*

Sample Date: *June 24, 2019* **Sampled By:** *Prateek Ahuja - Cambium Inc.*

Location: *BH 104-19 SS 2* **Depth:** *0.8 m to 1.2 m* **Lab Sample No:** *S-19-0462*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 104-19	SS 2	0.8 m to 1.2 m	13	52	34		16.8

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silty Sand some Gravel some Clay	SM	0.410	0.036	-	-	-

Issued By: _____ *Date Issued:* *July 8, 2019*

(Senior Project Manager)

Cambium Inc. (Laboratory)
866.217.7900 | cambium-inc.com
701 The Queensway | Units 5-6 | Peterborough | ON | K9J 7J6

Appendix D
AquiferTest Pro Results

Cambium Inc.
52 Hunter Street East
Peterborough, ON
K9H 1G5

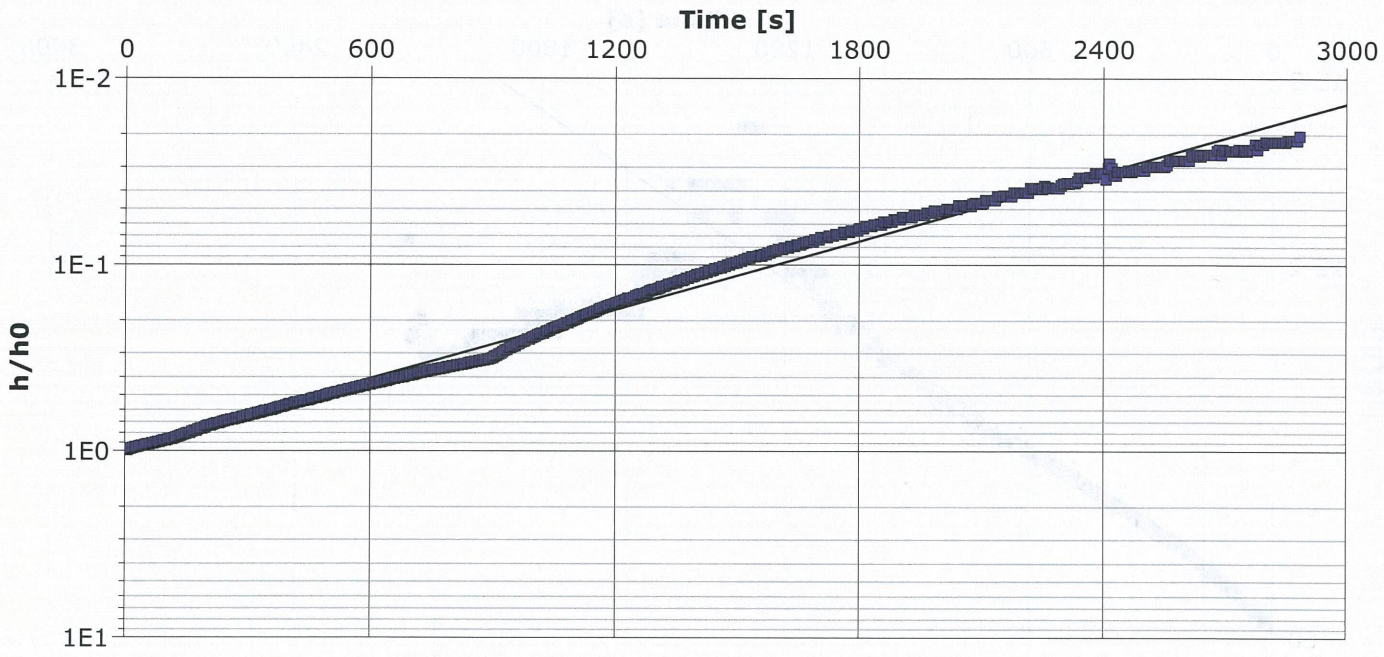
Slug Test Analysis Report

Project: Grant Morris Associates Ltd. - Geo-Environmental Studies

Number: 8964-001

Client:

Location: 5329 Old Brock Road	Slug Test: Recharge	Test Well: MW101-19
Test Conducted by: M.Francis		Test Date: 8/28/2019
Analysis Performed by: M.Francis	Recovery Analysis	Analysis Date: 8/29/2019
Aquifer Thickness: 5.00 m		

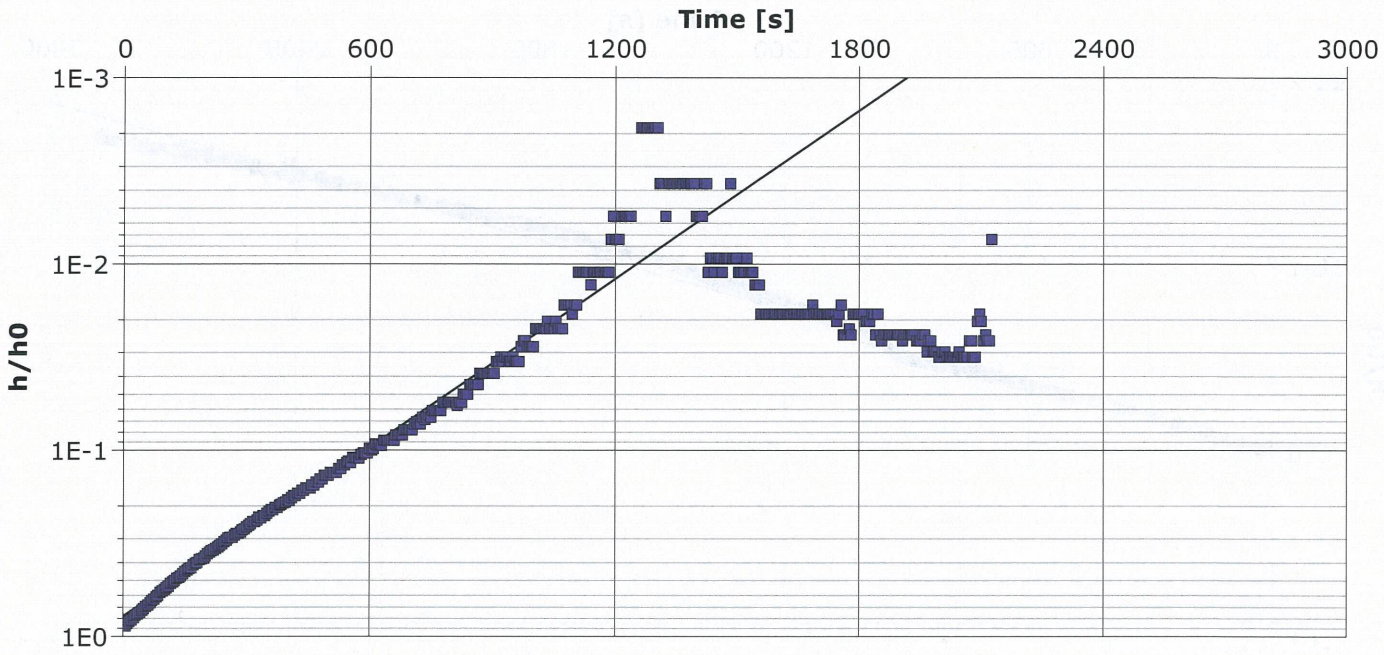


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW101-19	7.12×10^{-7}	

Cambium Inc. **52 Hunter Street East** **Peterborough, ON** **K9H 1G5**	**Slug Test Analysis Report**	
	Project: Grant Morris Associates Ltd. - Geo-Environmental Studies	
	Number: 8964-001	
	Client:	

Location: 5329 Old Brock Road	Slug Test: Slug Test 1	Test Well: MW101-19
Test Conducted by: M.Francis		Test Date: 8/28/2019
Analysis Performed by: M.Francis	Slug In	Analysis Date: 8/29/2019
Aquifer Thickness: 5.00 m		

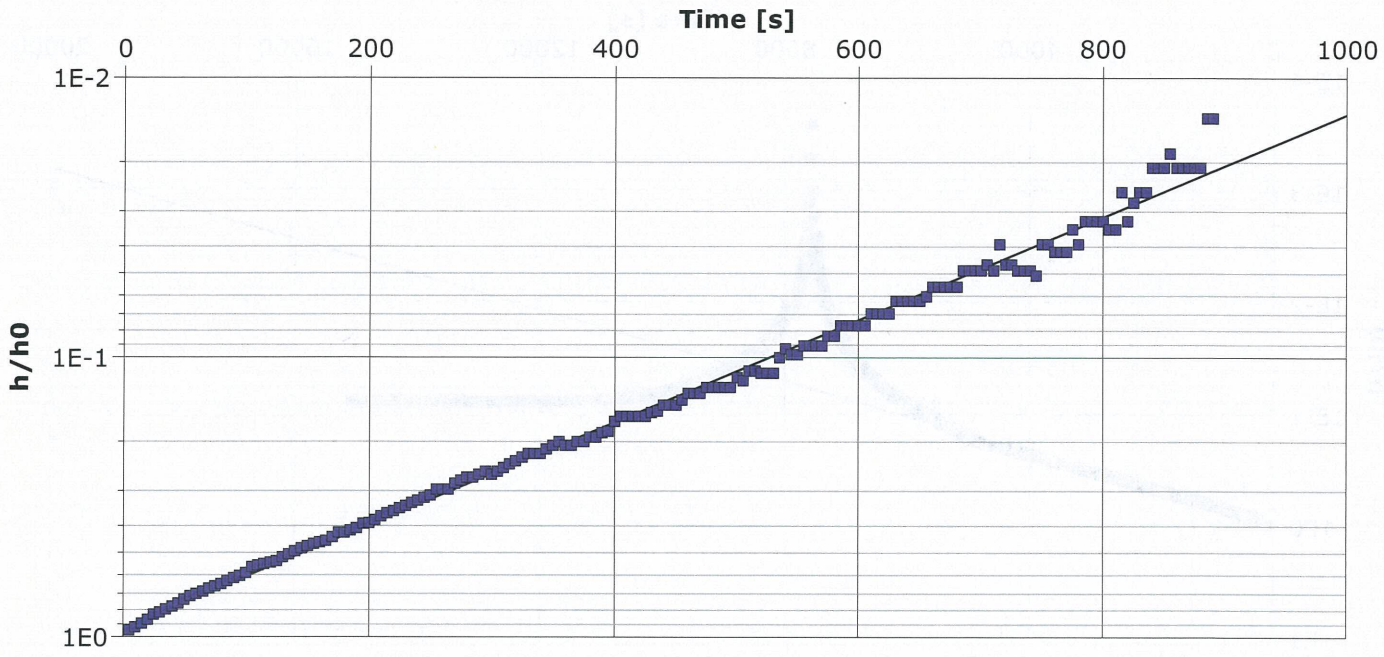


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW101-19	1.75×10^{-6}	

Cambium Inc. **52 Hunter Street East** **Peterborough, ON** **K9H 1G5**	**Slug Test Analysis Report**	
	Project: Grant Morris Associates Ltd. - Geo-Environmental Studies	
	Number: 8964-001	
	Client:	

Location: 5329 Old Brock Road	Slug Test: Slug Test 1	Test Well: MW101-19
Test Conducted by: M.Francis		Test Date: 8/28/2019
Analysis Performed by: M.Francis	Slug Out	Analysis Date: 8/29/2019
Aquifer Thickness: 5.00 m		

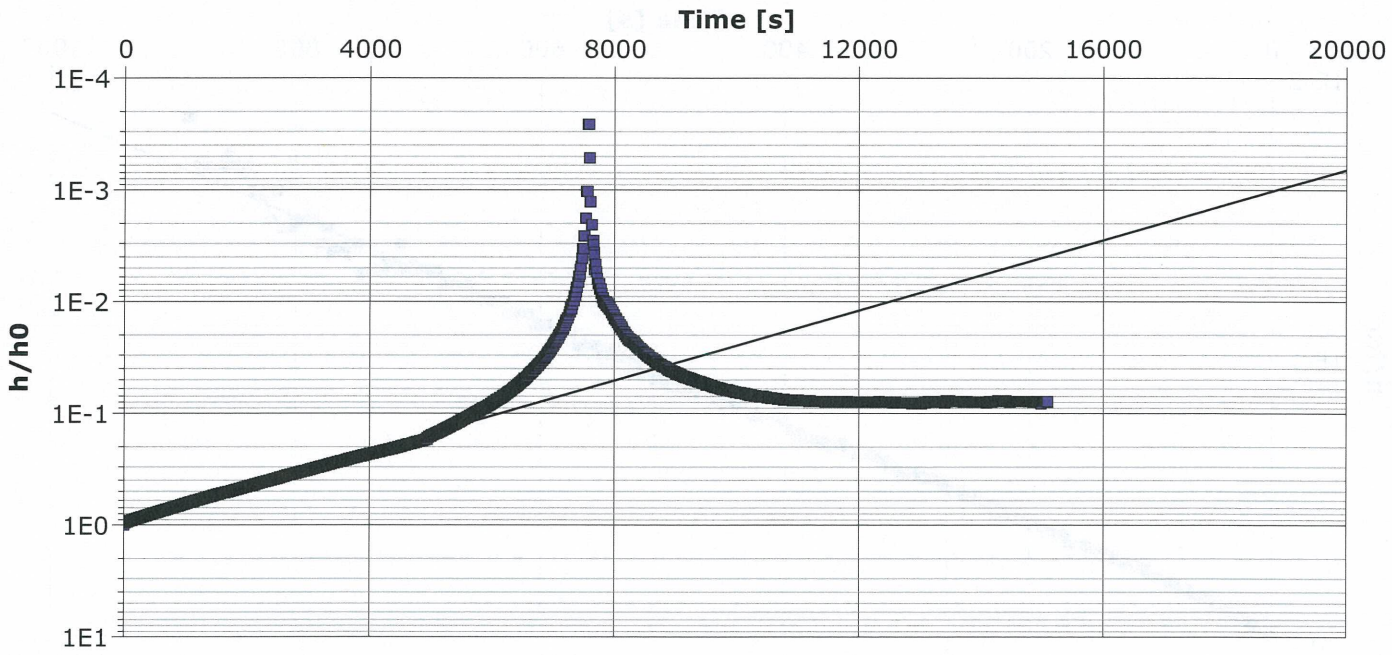


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW101-19	2.13×10^{-6}	

Cambium Inc. **52 Hunter Street East** **Peterborough, ON** **K9H 1G5**	**Slug Test Analysis Report**	
	Project: Geo-Environmental Studies	
	Number: 8964-001	
	Client: 1972229 Ontario Ltd.	

Location: 5329 Old Brock Road	Slug Test: Slug Test 1	Test Well: MW102-19
Test Conducted by: M.Francis		Test Date: 8/28/2019
Analysis Performed by: M.Francis	Recovery	Analysis Date: 8/29/2019
Aquifer Thickness: 6.50 m		

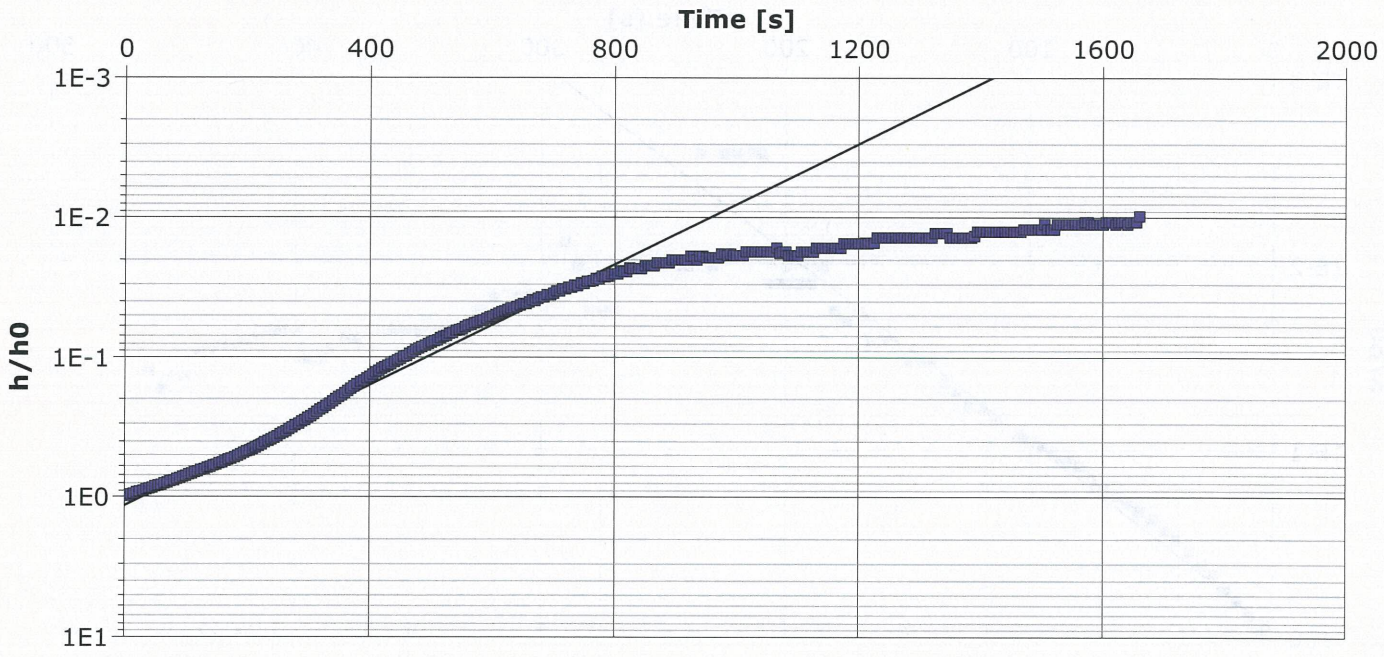


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]
MW102-19	1.82×10^{-7}

Cambium Inc. **52 Hunter Street East** **Peterborough, ON** **K9H 1G5**	**Slug Test Analysis Report**	
	Project: Geo-Environmental Studies	
	Number: 8964-001	
	Client: 1972229 Ontario Ltd.	

Location: 5329 Old Brock Road	Slug Test: Slug Test 1	Test Well: MW104-19
Test Conducted by: M.Francis		Test Date: 8/28/2019
Analysis Performed by: M.Francis	Recovery	Analysis Date: 8/29/2019
Aquifer Thickness: 5.00 m		

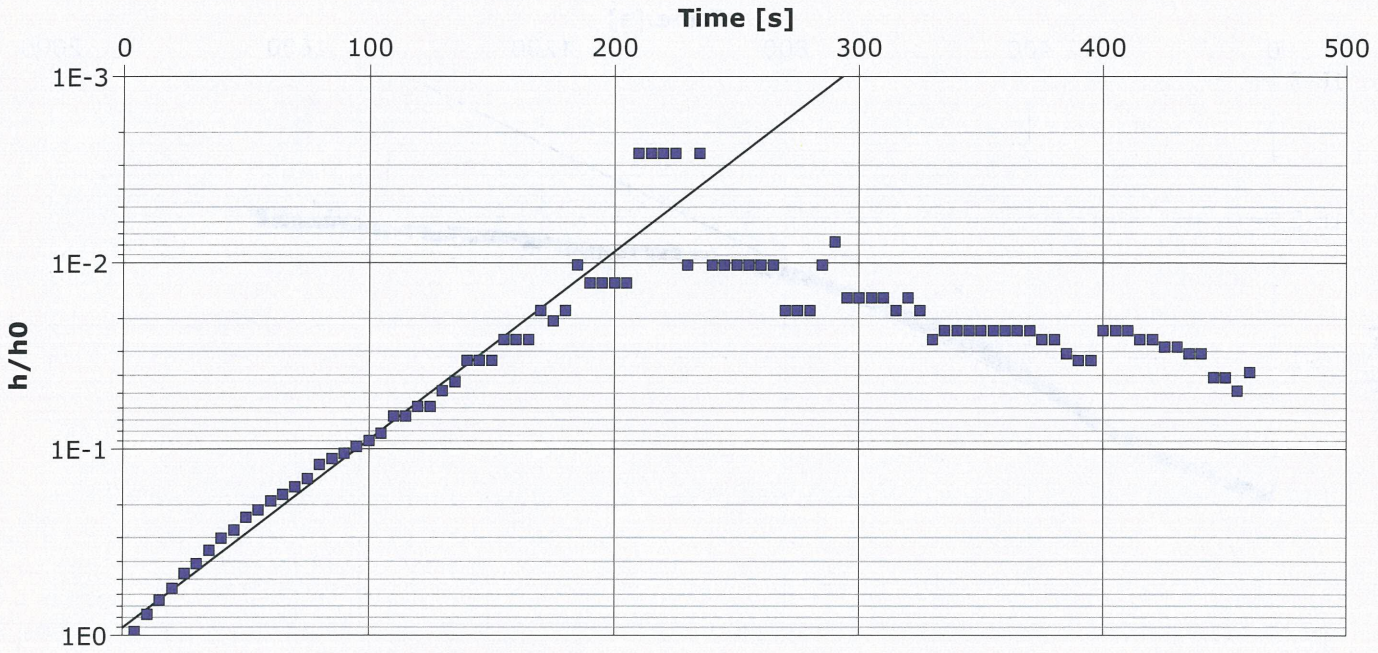


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW104-19	2.50×10^{-6}	

Cambium Inc. 52 Hunter Street East Peterborough, ON K9H 1G5	**Slug Test Analysis Report**
	Project: Geo-Environmental Studies
	Number: 8964-001
	Client: 1972229 Ontario Ltd.

Location: 5329 Old Brock Road	Slug Test: Slug Test 1	Test Well: MW104-19
Test Conducted by: M.Francis		Test Date: 8/28/2019
Analysis Performed by: M.Francis	Slug In	Analysis Date: 8/29/2019
Aquifer Thickness: 5.00 m		

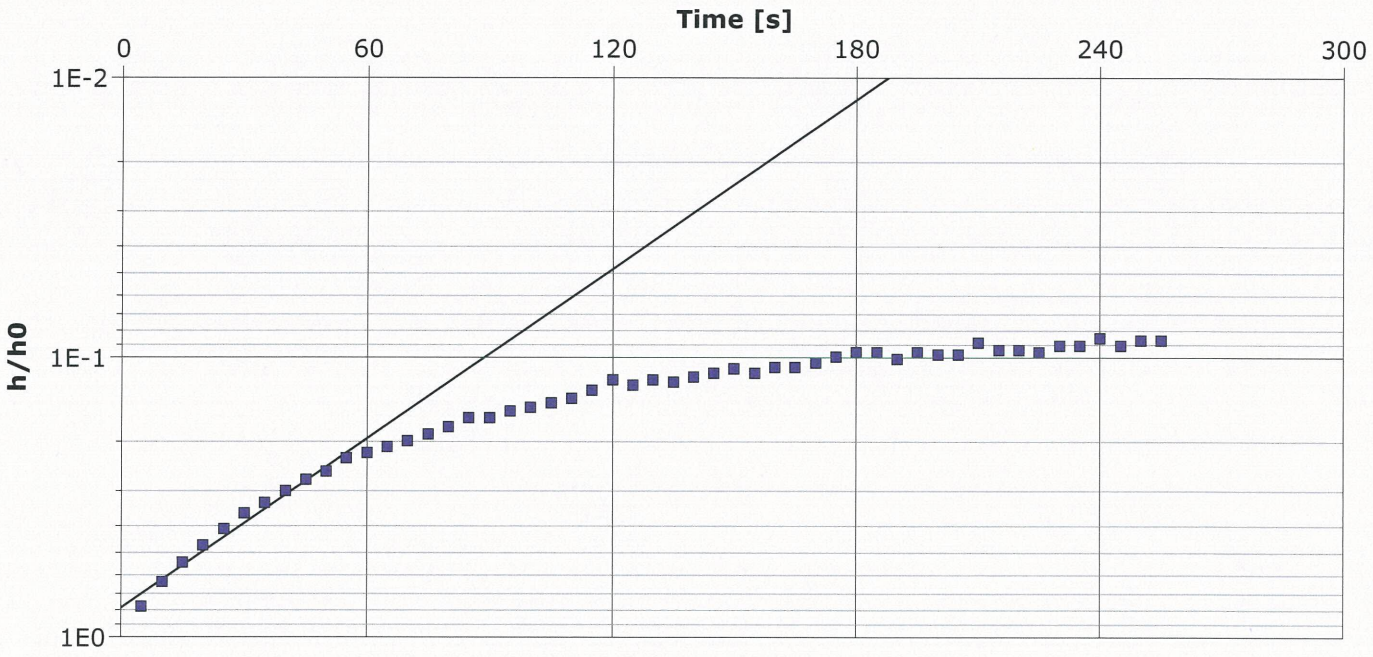


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]
MW104-19	1.17×10^{-5}

Cambium Inc. 52 Hunter Street East Peterborough, ON K9H 1G5	**Slug Test Analysis Report**
	Project: Geo-Environmental Studies
	Number: 8964-001
	Client: 1972229 Ontario Ltd.

Location: 5329 Old Brock Road	Slug Test: Slug Test 1	Test Well: MW104-19
Test Conducted by: M.Francis		Test Date: 8/28/2019
Analysis Performed by: M.Francis	Slug Out	Analysis Date: 8/29/2019
Aquifer Thickness: 5.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW104-19	1.17×10^{-5}	

Appendix E
Evapotranspiration Calculations

THORNTHWAITE-TYPE MONTHLY WATER-BALANCE MODEL													
Location	Claremont, Ontario												
Latitude	44.2 Degree												
Declination (deg)	-21.30	-13.30	-2.00	9.80	18.90	23.30	21.30	13.70	3.00	-9.00	-18.60	-23.30	
Declination (rad)	-0.37	-0.23	-0.03	0.17	0.33	0.41	0.37	0.24	0.05	-0.16	-0.32	-0.41	
DayLength (hr)*	9.02	10.22	11.74	13.29	14.60	15.31	14.98	13.83	12.39	10.81	9.44	8.69	
													Total
Precipitation (mm)	62.1	50.5	53.2	74.1	79.6	82.8	79	76.2	81.8	68	80	65.7	**853**
Temperature (°C)	-5.8	-5.6	-0.4	6.7	13	18.6	21.2	20.2	15.7	8.9	3.1	-2.9	-
Potential Evapotranspiration (mm)	0	0	0	43.1	70.7	104	119	103	70.8	40.5	24.1	0	**576**
Surplus	**277**	mm/yr											
PET Calc													
IF(T>0,924*DayLength*0.611*EXP(17.3*T/(T+237.3))/(T+273.2),0)													